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Amendment and Response

Serial No.: 09/942,200

Confirmation No.: 8194

Filed: 29 August 2001

For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME**Remarks**

The Final Office Action of July 26, 2006 has been received and reviewed. With claims 23, 27, 32, and 37 having been amended, claims 50-51 having been added, and no claims having been canceled, the pending claims are claims 23, 25-27, 30-34, 37, and 41-51. Reconsideration and withdrawal of the rejections are respectfully requested for at least the reasons set forth below.

Claim Amendments

Claims 23, 27, 32, and 37 are amended herein to include the recitation: x is in the range of about 0.95 to about 0.995. This amendment finds support in the application as originally filed (see, e.g., *Specification*, page 7, lines 1-9).

New Claims

Please enter and consider new claims 50-51. These claims find support in the application as originally filed, see, e.g., page 14, lines 15-24.

The 35 U.S.C. §103(a) Rejections

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

M.P.E.P. § 2143.

Claims 23, 25-27, 30-34, 37, 42, 44-45, 47, and 49

Claims 23, 25-27, 30-34, 37, 42, 44-45, 47, and 49 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Wolters et al. (U.S. Patent No. 5,744,832). Applicant traverses this rejection for at least the following reasons.

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Amended independent claims 23, 27, 32, and 37 each recite a platinum(x):ruthenium alloy, where "x is in the range of about 0.95 to about 0.995." As the Office Action admits (*see Office Action*, page 2), Wolters et al. does not (among other deficiencies) "disclose the value of x [as being] in the range of about 0.90 to about 0.98." However, the Examiner asserts that "it would have been obvious to one of ordinary skill in the art . . . to modify Wolters by having the value of x being in the range of about 0.90 to about 0.98, since it has been held that where the general conditions of a claim are disclosed in the prior art discovering the optimum or working ranges involves only routine skill in the art," citing *In re Aller* 105 USPQ 233 (CCPA 1955) for support. The same assertion was noted with respect to those claims that recite the value of x being about 0.95 (e.g., claims 25 and 49). Applicant strenuously disagrees with the allegation that it would be obvious to modify Wolters et al. in the manner proposed by the Office Action.

Wolters et al. is directed to "a method which results in a semiconductor device having a good electrical contact between the conducting region and the lower electrode," (Col. 3, Lns. 57-60). To achieve this goal, Wolters et al. teaches a method that provides alternately depositing platinum with a metal capable of forming a conductive oxide (*see, e.g.*, Col. 6 Lns 8-12). "Preferably, ruthenium is provided as the metal capable of forming a conductive oxide. A platinum layer with more than 15% ruthenium and a ruthenium oxide layer together form a very effective barrier against oxygen," (Col. 4, Lns. 15-19).

Accordingly, Wolters et al. describes a "layer 111 comprising platinum" that "contains more that 15 atom % of a metal capable of forming a conductive metal oxide [i.e., ruthenium]," (*see, e.g.*, Col 5, Lns. 31-35).

However, to illustrate its invention, Wolters et al. does demonstrate, in Figure 2, a platinum layer (111) having approximately 10% ruthenium. Such a configuration could potentially yield a theoretical maximum platinum content of approximately 90% (although the actual content would be lower, e.g., due to the presence of other materials (e.g., O, Ti, W) in the layer (*see Figure 2*)).

Wolters et al. asserts, however, that at this concentration, an undesirable tungsten oxide layer is "formed at the boundary 4 between the conducting tungsten layer 5 and the layer 11"

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(Col. 5, Lns. 41-60). Figure 3 of Wolters et al., on the other hand, illustrates that only a very small quantity of oxygen is present at the boundary 4 for a ruthenium percentage above 15% (approximately 30% in the example of Figure 3).

The Office Action asserts, however, that it would be merely a matter of routine skill in the art to discover the optimum platinum ranges claimed by the Applicant. While different ranges may not, in and of themselves, always support patentability, the M.P.E.P. clearly states that a prima facie case of obviousness may be rebutted by showing that the art "teaches away from the claimed invention." (M.P.E.P., § 2144.05 (III)). Applicant submits that, not only does Wolters et al. fail to teach or suggest a platinum(x): ruthenium layer, wherein x is in the range of about 0.95 to about 0.995 as claimed, it clearly teaches away from such a concentration by suggesting use of a corresponding layer having a theoretical maximum of no more than 90, and preferably less than 85 atomic percentage, platinum (based on the ruthenium concentrations recited by Wolters et al.). In fact, Wolters et al. illustrates that a layer having more than 85 atomic percentage platinum results in the formation of the undesirable tungsten oxide layer, while layers having less than 85 atomic percentage do not. If anything, Wolters et al. would thus motivate one of skill towards decreasing the atomic percentage of platinum (e.g., increasing the atomic percentage of ruthenium), rather than increasing platinum concentration to the levels recited in Applicant's claims.

Further in view of the above, to modify Wolters et al. as suggested by the Office Action (i.e., to increase its atomic percentage of platinum to the range claimed by the Applicant) would clearly render Wolters et al. unsatisfactory for its intended purpose, i.e., result in excessive oxide layer formation as discussed above. As the M.P.E.P. makes clear, "[i]f proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification."

M.P.E.P. § 2143.01 (V.), citing *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

For these and other reasons, Applicant submits that amended independent claims 23, 27, 32, and 37 are not obvious over Wolters et al. Moreover, the rejected claims dependent upon these claims (e.g., claims 25, 26, 30, 31, 33, 34, and 42, 44, 45, 47, and 49) are also submitted to

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be patentable over Wolters et al. not only due to their dependence, but also because of the particular subject matter recited therein. Reconsideration and withdrawal of the rejection are requested.

Claims 41 and 46

Claims 41 and 46 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Wolters et al. in view of Bronner et al. (U.S. Patent No. 6,177,696). For the reasons already identified above, Wolters et al. fails to teach, or even suggest, the range of x recited in amended independent claims 23 and 37 (from which claims 41 and 46 respectively depend). Nothing is identified within the disclosure of Bronner et al. that remedies this deficiency.

Moreover, there is no motivation identified to combine the sputtered barrier layer of Wolters et al. with the apparent CVD trench processes described by Bronner et al. For at least these reasons, reconsideration and withdrawal of the rejection are respectfully requested.

Claims 43 and 48

Claims 43 and 48 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Wolters et al. in view of Sandhu et al. (U.S. Patent No. 5,335,138). For the reasons already identified above, Wolters et al. fails to teach, or even suggest, the range of x recited in independent claims 23 and 37 from which claims 43 and 48 respectively depend. Nothing is identified within the disclosure of Sandhu et al. that remedies this deficiency. For at least this reason, reconsideration and withdrawal of the rejection are respectfully requested.

Comments on "Response to Arguments"

Applicant has amended independent claims 23, 27, 32, and 37 to reflect that x is in the range of about 0.95 to about 0.995, clearly beyond the concentrations taught or suggested by Wolters et al.

Figure 2 of Wolters et al. is provided to comparatively show that, when the layer 11 has an atomic percentage of ruthenium lower than 15%, e.g., approximately 10%, then the

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undesirable tungsten oxide layer will be formed. The Office Action appears to reason that because Wolters et al. shows a layer with approximately 10% ruthenium, Applicant's claimed ranges are merely optimization.

However, Applicant submits that any suggested optimization of the ruthenium content of the Wolters et al. layer would clearly be to provide a layer with more than 10%, and preferably more than 15% ruthenium. As the M.P.E.P. clearly states, Applicant is permitted to rebut a *prima facie* obviousness rejection by showing that the art, in any material respect, teaches away from the claimed invention. (M.P.E.P., § 2144.05 (III.)). Applicant submits that the Office's assertions are adequately rebutted by illustrating that Wolters et al. clearly teaches that any advantages of its layer are present when the ruthenium content is above at least 15%, but not present when the layer contains 10% ruthenium or less. Thus, it teaches away from the claimed invention (e.g., teaches away from a platinum concentration of about 0.95 to about 0.995).

Based at least upon these remarks, it is respectfully requested that the pending rejections be withdrawn.

New Claims

Claims 50-51 are submitted to be allowable in view Wolters et al. and indication of the same is respectfully requested.

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It is submitted that the pending claims are in condition for allowance and notification to that effect is requested. The Examiner is invited to contact Applicant's Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted

By

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CERTIFICATE UNDER 37 CFR §1.8:

The undersigned hereby certifies that the Transmittal Letter and the paper(s), as described herein above, are being transmitted by facsimile in accordance with 37 CFR §1.6(d) to the Patent and Trademark Office, addressed to Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 26th day of October, 2006, at 3:25pm (Central Time).

By:

Name: Sam E. Wigart